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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 14

Application Number: 08/915,658
Filing Date: August 21, 1997
Appellant(s): TRIVEDI, JIGISH D

Timothy W. Hagan
For Appellant

EXAMINER'S ANSWER

This is in response to appellant's brief on appeal filed January 10, 2001.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 31-40 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) *Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

4,910,578	Okamoto	3/1990
5,227,333	Shepard	7-1993

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(b) that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 31 to 34 stand rejected under 35 U.S.C. 102(b) as being anticipated by Okamoto (U.S. Pat. 4,910,578).

The claimed structure is anticipated by Okamoto which shows in Fig. 4D an interconnect comprising a composite structure comprising a first metal silicide 4, a second metal silicide 8, and an intermetallic compound 30 comprising metal from the first metal silicide and metal from the second metal silicide. Okamoto further teaches the first metal silicide and the second metal silicide each comprising a refractory metal selected from the group consisting of molybdenum, tantalum, titanium, and tungsten. Additionally, Okamoto teaches in Col. 5, lines 42-61, and Col. 6, lines 49-51, the use of titanium silicide as the first metal silicide, and the use of tungsten silicide instead of

molybdenum silicide as the second silicide on one of the embodiments of the interconnect.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 35 to 40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pat. 4,910,578) in view of Shepard (U.S. Pat. 5,227,333).

The claimed structure is ~~anticipated~~ disclosed by Okamoto which shows in Fig. 4D an interconnect comprising a composite structure comprising a first metal silicide 4, a second metal silicide 8, and an intermetallic compound 30 comprising metal from the first metal silicide and metal from the second metal silicide. Okamoto further teaches the first metal silicide and the second metal silicide each comprising a refractory metal selected from the group consisting of molybdenum, tantalum, titanium, and tungsten. Additionally, Okamoto teaches in Col. 5, lines 42-61, and Col. 6, lines 49-51, the use of titanium silicide as the first metal silicide, and the use of tungsten silicide instead of molybdenum silicide as the second silicide on one of the embodiments of the interconnect.

Okamoto teaches all the limitations in the claims with the exception of showing a field effect transistor having a source, a drain and a gate, formed in the semiconductor layer.

However, Shepard shows a conventional local interconnect for connecting source, drain or gate of a field effect transistor to another active area within a substrate assembly, the local interconnect comprises a composite structure that includes a plurality of metal silicide layers.

Thus, it would have been obvious to one of ordinary skill in the art to use the interconnect of Okamoto to connect a source, drain or gate to another area within a substrate assembly as taught by Shepard. Furthermore it would have been within the scope of one of ordinary skill in the art to use an interconnect with a composite structure as the one taught by Okamoto in order to obtain a reliable interconnect that provides a good electrical contact to silicon with a lowered resistivity.

Furthermore, it would have been obvious to use an interconnect structure as the one taught by Okamoto in a memory array, as memory arrays are well known to be large-scale semiconductor integrated circuits (LSI), and the teachings of Okamoto are directed to interconnection films in LSI.

(11) Response to Argument

The first instant structure essentially comprises a composite structure comprising a first metal silicide, a second metal silicide, and an intermetallic compound, where the

intermetallic compound comprises metal from the first metal silicide and metal from the second metal silicide. The first metal silicide and the second metal silicide each comprise a refractory metal selected from the group consisting of chromium, cobalt, molybdenum, nickel, niobium, palladium, platinum, tantalum, titanium, tungsten, and vanadium.

The second instant structure essentially comprises the use of the first instant structure described above as the local interconnect for connecting a first active semiconductor region to a second active semiconductor region on a substrate, where the second instant structure is a memory array that utilizes the interconnect structure for connecting one of a source, drain or gate of one field effect transistor to the source, drain or gate of a second field effect transistor.

Appellant primarily argues that Okamoto teaches the formation of a ternary silicide, and not the formation of an intermetallic compound.

In particular, appellant argues that Okamoto does not mention expressly or inherently the formation of an intermetallic compound from two different metals in different metal silicide layers, and that Okamoto rather teaches the possible formation of a ternary silicide film from the reaction that may take place between two films, basing its conclusion on the fact that Okamoto recites that due to the heat treatment for forming an impurity diffusion layer, metallurgical reaction may take place between a titanium silicide film and a molybdenum silicide film.

While it is correct that Okamoto recites that the reaction may occur and that the film formed is a ternary silicide film, it is respectfully submitted that Okamoto teaches the conditions under which the composite film may be formed in Col. 5, lines 35-61, and that a ternary silicide film is indeed an intermetallic compound.

Appellant has asserted that the claimed "intermetallic compound" should be construed as one skilled in this art would construe the term, and refers to an Encyclopedia Britannica definition for the term. Furthermore, appellant pointed out that the Academic Press Dictionary of Science and Technology defines "intermetallic compound" as "an intermediate phase in which the compounds are metallic".

It is respectfully submitted that according to the Merriam-Webster's Collegiate Dictionary, intermetallic is defined as "composed of two or more metals or a metal and a nonmetal; specifically being an alloy having a characteristic structure and usually a definite composition". Furthermore, in Vol. 3, Page 826 of the Kirk-Othmer's Encyclopedia of Chemical Technology, it is recited that molybdenum silicide is an intermetallic compound. It is also taught that metal silicides form well defined crystals with a bright metallic luster, thus titanium silicide is an intermetallic compound. Thus, titanium silicide and molybdenum silicide being intermetallic compounds, when these two films are reacted together they will form a ternary metal silicide with a definite structure given by $Ti_xMo_ySi_z$, that is an intermetallic compound. There is no evidence to support appellant's contention that a ternary metal silicide is not an intermetallic compound.

It remains apparent to one skilled in the art that the interconnect structure of Okamoto comprising a first metal silicide, a second metal silicide, and an intermetallic compound formed by the exposure to high temperature of the structure containing the two metal silicides, anticipates the appellant's interconnect structure comprising a metal silicide, a second metal silicide, and an intermetallic compound formed by the exposure to high temperature of the structure.

Appellant argues that the Examiner's analysis ignores the totality of the claim language in reference to the intermetallic compound comprising metals from two different metal silicide layers. It is respectfully submitted that the ternary silicide layer of Okamoto comprises metal from the first metal silicide and metal from the second metal silicide in addition to silicon.

Appellant argues that one of ordinary skill in the art would not think to combine the teachings of Okamoto with those of Shepard, because although Shepard teaches the formation of a local interconnect on a field effect transistor, Shepard uses a completely different process to create a local interconnect having a germanium layer, and that the teachings of Okamoto would not be properly combinable because a completely different semiconductor device is taught using different materials.

It is submitted that Shepard teaches a local interconnect comprising a germanium layer, a polysilicon layer, and a plurality of conducting films covering the polysilicon, where the plurality of conducting films can be metal silicide films. The teachings of Okamoto are directed to electrode interconnects that comprise a plurality

of conducting films, where the conducting films are metal silicide films. The motivation to combine is the shows that it is well known and desirable in the art to characteristic of metal silicides of lower resistivities that can be an advantage for interconnect structures. Even if the semiconductor devices could be considered to be different, which are not, because a connection from a source or drain to another source or drain is the same connection of electrodes that Okamoto teaches, the art is analogous as being directed to interconnect structures in LSI circuits.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Ginette Peralta
March 23, 2001

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Appeal conference held on: 1/29/2001
Conference Attendees:

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